Columbia University GSAPP
Spring 2020
Instructors: Lindy Roy and Leah Kelly
Thursday 7:00 - 9:00PM

Building Sense: Provocations from Neuroscience

Environment, system, matter, form. This is the language of Architecture. But these concepts are also fundamental to other rapidly advancing fields including Neuroscience. As the properties of sensing, adapting, decision-making and motion inherent to the nervous system are elucidated and described, the potential for more intelligent, evolving and even conscious design will no doubt emerge. Will architects be equipped to participate if engagement with these terms remains largely locked within a lexicon limited to analogy and metaphor?

Similarly, architects are engaged in an energy economy usually confined to the thermodynamics of materials and bodies in space. This course expands this view to encompass the reality that every encounter with the environment, every sense, movement, or decision be it at the retina, neuromuscular junction or cortex, is a constant transfer from one form of energy to another.

In this seminar an *architect* and a *neuroscientist* explore convergent concepts from their respective fields and critique their default meanings. By exploring how these ideas are understood from a neuroscientific perspective we will reframe environment as not only stimuli to be perceived and navigated but as an evolving extension of the self and driver of behavior forming an ecology of habit, novelty and attention.

This class is structured as a conversation between *neuroscientist* and *architect*. Foundational principles of neuroscience will be surveyed in weekly readings providing an overview of current theories of how we think about the nervous system and its relationship to the environment. In-class presentations and readings will be catalysts for discussion.

Active student participation is expected and required. Students will submit two questions based on the weekly readings the night before class. These questions will be incorporated into the class discussion. The required course submission will be a written, graphic or computational investigation of topics covered during the semester. Preliminary research will be presented at midterm.

In-class presentations and discussion of weekly reading will examine the following topics to define new potentials for architecture and expand our understanding of what we are doing when we design.

Weeks 1 + 2
What is an environment?
Umwelt, Internal/External
Membranes, internal and extended consciousness

Weeks 3 + 4
What is a stimulus?
Affordances, the sense organs, perception, attention

Weeks 5 + 6
Being in space
Embodied cognition, proprioception, mapping, movement

Weeks 7 + 8
The co-ordinated being
Oscillations, rhythm, timing, movement, decision-making
Top down vs bottom up

Weeks 9 + 10
The evolving being
Development and growth
Plasticity, memory, emotion and habit

Weeks 11 + 12
The problem of representation
Representing relationships across multiple spatio-temporal scales
Visualizing the invisible

Bibliography

Bertil Hille, *Ion Channels of Excitable Membranes* (2001)
Jean-Pierre Changeux, *Neuronal Man: The Biology of Mind* (Princeton University Press: 1985)
Gerald Edelman, *Bright Air, Brilliant Fire: On The Matter Of The Mind* (Basic Books: 1992)
James J. Gibson, *The Ecological Approach To Perception* (Psychology Press: 1983)
Kurt Goldstein, *The Organism* (Zone Books: 1995)
Deborah Hauptmann and Warren Neideck eds, *Cognitive Architecture: From Biopolitics to Noopolitics* (010 Publishers: 2010)
Peter R. Huttenlocher, *Neural Plasticity: The Effects of Environment on the Development of the Cerebral Cortex* (Perspectives in Cognitive Neuroscience: 2002) Kandel, Schwartz, Jessell, Siegelbaum, Hudspeth, *Principles of Neural Science, Fifth Edition (*Hodgkin and Huxley: 2013)
Joseph Ledoux, *Synaptic Self: How Our Brains Become Who We Are* (Penguin Books: 2002) David Lewis-Williams, *Images of Power* (Thames and Hudson: 2000) Stephen L. Macknik and Susana Martinez-Conde, *Sleights of Mind* (Picador: 2010)
Daniel Lord Smail, *On Deep History and the Brain* (University of California Press: 2008) Jakob von Uexkull, *A Foray Into The Worlds Of Animals And Men* (Instinctive Behavior C.H. Schiller ed. International Universities Press: 1957)
Bruce E. Wexler, *Brain and Culture: Neurobiology, Ideology and Social Change* (MIT Press: 2006)